Enhancement of Take-A-Break Notification

by

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15893

Dissertation submitted in partial fulfilment of

the requirements for the

Bachelor of Technology (Hons)

(Business Information System)

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CERTIFICATION OF APPROVAL

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Approved by,

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BANDAR SERI ISKANDAR, PERAK

MAY 2015

MAY 2015

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgments, and that the original work contained herein has not been undertaken or done by unspecified sources or persons.

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(NORSHAMIERA BINTI AB RAHIM)

ABSTRACT

Enhanced Take-A-Break Notification is an application that runs on Windows operating system. This application is primarily focus on office workers who are having health problems related to Work-related Musculoskeletal Disorders (WSMD's). This is a continuation of previous project; Take-A-Break Notification which focuses on Computer Vision Syndrome (CVS). WSMD's are more risky than CVS since WSMD's will give effect to the whole body. This problem occurs when office workers have more workload and need to sit in front of computer screen for a longer period of time. The objective for this project is to enhance Take-A-Break Notification with the following items; an exercise video and information about the correct way for workers to apply a healthy ergonomic practice. The second objective is to study users' acceptance of the enhanced of Take-A-Break Notification. The scope of this study is for office workers. Office workers have the most tendencies to sit in front of computer screen for a long duration. System Development Life Cycle (SDLC) has been chosen as the methodology for this project. This application will dim the computer screen, disable the mouse and keyboard, indirectly forcing the employees to stop working and the exercise video will be displayed and followed by the information about the correct way for workers to apply ergonomics in their daily working environment. This application is developed with the intention to increase the awareness on health problems that always occur in a workspace.

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CHAPTER 1

PROJECT BACKGROUND

1.1 Introduction

Nowadays, there are an increasing development in computer technology which makes life easier, but it also can give bad impact to the users that are frequently using the products. Official communications are mainly done through computer rather than direct and conventional way. There are millions of people who interact with computers every day. However, not all of them are aware about the consequences of sitting in front of the computer for a long period of time. Many studies have shown that there are many people who use computer every day without realizing that it can be harmful to their health. New research suggests that sitting in front of a computer screen for five hours a day can dramatically increase the risk of depression and insomnia, (Olinka, n.d.).

The International Ergonomics Association defines ergonomics or human factors as follows:

"*Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance"*

Ergonomics usually occur in the working environment. There are many types of ergonomics in the workplace. However, not many people know what ergonomics are all about. Ergonomics also can lead to the inefficient performance of the workers, plus it will also determine the company overall performance and budget. This project will focus on the human-computer interaction.

By applying ergonomics to daily life working environment, it can prevent our body from health problems. Since the workers are safe from the health problems, they can increase their overall performance while doing their jobs. We also can reduce the percentage of workers applying for leave due to the lack of knowledge about the ergonomics. On top of that, organizations need to bear the cost of treatment such as doctor's bills, physical therapy, prescriptions and increased insurance premiums in order to make sure their employees can get back to work.

A 2005 report in the Journal of the American Medical Association (JAMA) estimated Americans spend $86 billion a year on treating neck and back pain, probably more than any other ailment (Cynthia, 2011). Ergonomics leads to the health problems such as having eyestrain, back pain, shoulder tendinitis and bursitis, and etc. Ergonomics also can lead to stress. Workers who usually work with computer for longer periods of time will results to Computer Vision Syndrome (CVS) and Work-related Musculoskeletal Disorders (WMSD's).

HSE figures show that in Great Britain, an estimated 439,000 workers in 2011/12 suffered from musculoskeletal disorders caused or made worse by their current or past work (IOSH, 2015). Most of the cases are due to Work-Related Musculoskeletal Disorders (WMSD's) since the workers are not aware about their behaviour while doing their jobs. Untreated or mistreated, the problem can worsen or persist for months or even years (Cynthia, 2011). Hence, it is very critical for workers to be made aware and start practising good ergonomics to ensure their health condition do not deteriorate.

1.2 Problem Statement

1.2.1 Problem Identification

This project is a continuous project from previous student by Nellmondee Julius. The current system for ergonomics is Computer Vision Syndrome (CVS) that are only focusing on eyestrain. Hence, there is a need to enhance the current application which is called Enhanced Take-A-Break Notification.

One of the single largest class of injury claims in the office are Work-related Musculoskeletal Disorders (WMSD's), which account for over 40% of all Washington State Fund workers' compensation claims among office workers

(WISHA Services Division, 2002). Most of the workers in an organization interact with computer every day. Some of them are sitting in front of the computer screen for long period of time. They also are complaining about having low back strain, neck strain, hand and wrist tendinitis and etc. after working. Some people have already started experiencing Repetitive Strain Injury (RSI) from an improperly set up desk (Whitson, 2011). These are serious issues that organization needs to look into to ensure the health condition of their workers will not disrupt the organization well-being as a whole.

1.2.2 Significance of Study

Office workers are the people who are most expose to prolonged usage of computer since they are sitting in front of the computer screens for long period of time. Office workers may not just be having Computer Vision Syndrome (CVS), if they are still continuously repeating the same motion it will lead to Work-related Musculoskeletal Disorders (WSMD's). As a worker they also have a right to a safe workplace environment. Musculoskeletal disorders can range from mild to severe and, as they are cumulative in nature, can be measured depending on the severity/longevity of the pain and the extent to which the pain affects a person's ability to work (Renieshaw, 2012).

WSMD's are more risky than CVS since WSMD's will give effect to the whole part of our body. When the workers are having too much workload, they will forget to take a break for a few minutes before they can continue working. This system will display a video for workers to do an exercise after sitting in front of the computer screen for a long period of time. After the exercise video is displayed, it will then shows to the worker information about the correct way of ergonomics that they must follow. The usage of this system may enhance the energy level of the workers and may improve the productivity of the organization.

1.3 Objectives

There are a few objectives of this project. Since this project is an enhancement from previous work, the first objective is focusing on the functionality enhancement. The second objective is focusing on user acceptance. Below are the objectives of this project:

- To enhance Take-A-Break Notification with the following items:
    i. Exercise video.
    ii. Information about the correct way for workers to apply ergonomics.
- To study the users acceptance of the enhance Take-A-Break Notification.

1.4 Scope of Study

The scope of this study is office workers. Since UTP lecturer and staff spend a lot of their time in front of computer screen, they are chosen as the target for this project. This system will remind them to take a break before they can continue with their jobs. Students also are invited to use this system for their personal use.

1.5 Project Feasibility

Before this project is being commercialized, I need to work on the prototype and documentation first. For this project, project feasibility will cover in terms of scope, time frame and cost-effectiveness. The project feasibility has the following items:

Scope

- The first target user is office workers comprising of UTP lecturer and staff.
- Usually office workers work eight hours per day, so their time in front of computer screen usually up to six hours per day.

Time frame

- Research will be conducted for the first 4 months, which will consume the first semester.
- Project development requires 2-3 months of the second semester.

Cost-effectiveness

- The cost for this application will incur minimal budget.
- For the development phase, this project will be developed using Visual Studio 2013.
- For research, it only requires online resources such as research papers, journals, articles and many more.

CHAPTER 2

LITERATURE REVIEW

2.1 Ergonomics

Human factors and ergonomics (HF&E), also known as comfort design, functional design and user-friendly systems, is the practice of designing products, systems or processes to take proper account of the interaction between them and the people who use them (Thomson Reuters. 2014). Ergonomics focus on the physical and mental capabilities and the time period between the workers to interact with the tool, equipment, work methods, tasks and working environment. Ergonomics also can affects workers performance towards the job. Workers can reduce the number of injuries by applying ergonomics to their working environment. HF&E is employed to fulfil the goals of occupational health and safety and productivity (Thomson Reuters. 2014). In conclusion, by applying ergonomics it can helps workers to be more effective, efficient and give a good performance in their works. In addition, company expenditure can be reduced to minimal level due to reduction of non-ergonomic incident treatment related expenses.

2.2 Ergonomics in workplace

As technologies keep changing, it supposedly improves workers' productivity. However, organization and workers need to be aware about the problem that may be derived from adaptation of new technology. Based on the *Office Ergonomics* published in (WISHA Services Division, 2002), Office Ergonomics is the branch of ergonomics dealing specifically with the office environment. According to the same journal, office ergonomics has been on computer work due to the rapid increase in computer use in the modern office and the associated increase in injuries. However, there are many injuries happened in the workplace due to the wrongly applied ergonomics while the workers are working.

Ergonomics is important for the workers as they are the one that can affect company sustainability.

The problems that might happen in the workplace due to the ergonomics are Computer Vision Syndrome (CVS), Repetitive Strain Injuries (RSIs), Repetitive Motion Injuries (RMIs) and Work-related Musculoskeletal Disorders (WMSDs). Due to the Computer Vision Syndrome (CVS), workers might have an eye strain that will result to near-sightedness and fatigue that will decrease workers performance towards their jobs. By practicing improper light sources, computer screen glare, improper positioning of the monitor, staring at a computer monitor for extended periods of time will result a physical problems to the workers. Workers tend to look at the computer screen for longer periods of time when they are in the middle of job completion. Workers might be having headache and blurred vision when they keep on staring at the computer screen for extended periods of time. Additionally, this practice will make discomfort feeling in the shoulders, neck or lower back.

Work-related Musculoskeletal Disorders (WSMD's) are group of painful disorders of muscles, tendons and nerves (Canadian Centre for Occupational Health & Safety, 2015). Based on *Office Ergonomics* published in (WISHA Services Division, 2002), the single largest class of injury claim in the office are Work-related Musculoskeletal Disorders (WSMD's), which account for over 40% of all Washington State Fund workers' compensation claims among office workers. The symptom of WSMD's are feeling of discomfort, pain, fatigue, swelling, stiffness and numbness and tingling. WSMD's are mainly caused by awkward postures and can be painful during work or rest.

The goal of an ergonomics program in industry is to adapt the workplace to a specific worker, dependent on the job description, required tasks, and physical makeup of the employee performing those tasks (Spine-health, n.d.). This will result a decrease in overall performance efficiently of the workers. Workers focus maybe affected by the symptoms mentioned above. By sitting in an office chair for a prolonged period of time, this will make the workers feel lower back pain. The tasks that have been given by the employer will also be delayed due to employee sickness.

There are many causes of these injuries such as repetitive movements, awkward postures and a lack of rest for the hands and wrists. If a person looking up at a monitor that is places too high, viewing a monitor placed too low or viewing document on the desk and holding the phone between the ear and the shoulder places a lot of stress on the joints and muscles. Improper posture while sitting can strain the ligaments in the spine that support the joints and create stiffness and inflammation in a joint (University of New Hampshire, n.d.). The lack of support from the chair, feet not touching the ground and over reaching for the keyboard or mouse are the causes of the upper or lower back pain.

Sitting in front of a computer screen for five hours a day can dramatically increase the risk of depression and insomnia, (Olinka, n.d.). Sitting in front of the computer not just giving us headaches, eye strain and blurry vison but it also result in having a depression and insomnia. Sitting for 8 hours has been linked to 65% more fatigue, and a greater incidence of diabetes, heart disease, musculoskeletal pain, and overall de-conditioning (Jane, n.d.). In this new era of technology, most of the people tend to spend most of their time in front of the computer screen. With the rapidly changing technology people are most likely to spend their time in front of the computer screen in order to finish their workloads, writing, reading, gaming, watching a movie and etc.

Now, one of the biggest investigations into the hazards of computers in the workplace has concluded that they can also damage mental health (Olinka, n.d.). Based on previous literature, there are many suggested the maximum hours to sit in front of the computer screens. According to the study that be conducted by WISHA Services Division in 2002, the data entry staff all spent over five hours per day doing repetitive keyboard work, while clerks averaged less than five hours per day at the keyboard (WISHA Services Division, 2002). Data entry workers tend to work for a longer period of time since they have many workloads that need to be done. They also sitting with an awkward posture, therefore results have shown that data entry workers are tend to have more injuries than clerks that only spent an average less than five hours per day (DataHum Inc.'s safety committee, 2002).

Sitting for more than three hours a day can cut two years off a person's life expectancy, even if he or she exercises regularly, a new study finds (Alice, 2012). This research are showing that not just by sitting in front of the computer screen could harm people, but only by sitting for more than three hours a day could also harm people's life. This result suggests the prevention of mental disorders and sleep disorders requires the restriction of computer use to less than five hours a day (Nakazawa, 2015). There are many type of injuries will happen if the workers working for a longer period of time in front of the computer screen. In order to achieve the key performance indicator (KPI) in an organization, workers are scarifying their health in order to achieve the organization goals.

Different types of works have been performed (Nakazawa, 2015). Workers not just doing their jobs in front of the computer screen, some of them also need to read while doing research. With the improper sitting, this will lead the workers to have injuries while performing their job. Research by Psychology Cary Cooper from the University of Manchester Institute of Science and Technology said concern was growing over mental health problems caused by working with computers (Olinka, n.d.). The problem is not just sitting in front of computer but the fact that people don't take a break and cannot priorities what they are doing (Cary, 2015). This is important for the workers to take a break before they continue doing their jobs. Another expert believed that taking five minutes break from intensive computer operation in each hour is encouraged as a good practice and reasonable precaution to protect health and safety of workers (Professional and Specialized Services, 2004).

A spokesman for the Health and Safety Executive stated that bosses had a duty under the 1974 Health and Safety Act to protect the mental as well as physical health of staff, even though psychological damage was harder to prove (Olinka, n.d.). The management are playing important roles for this case; they have to make sure that all their workers are following the exact concept of ergonomics. Workers are not aware about the way they working, the management need to conduct a full training about the awareness of office ergonomics for the workers benefit and also for the management profit.

2.3 Computer Vision Syndrome (CVS)

Previous research related to sitting in front of the computer screens. This research is mainly focusing on Computer Vision Syndrome (CVS). CVS can also causes by a number of different factors including computer glare, improper positioning of the monitor, spending more than three hours a day on computer and wrong prescription for corrective lenses (Quilter, 2012). Computer Vision Syndrome, also referred to as Digital Eye Strain, describes a group of eye and vision-related problems that result from prolonged computer, tablet, e-reader and cell phone use (American Optometric Association, n.d.). The example of health problems that causes from CVS are eyestrain, headaches, and blurred vision.

People tend to spend their time rather than being socialized with their environment. There are many things that will influence people to sitting in front of the computer screen for a longer period of time such as watching a movie, finishing their workloads and social networks. Studies have shown that people are willing sitting in front of television with an average of six hours a day (Mercola, 2012). A second study, published in the October issue of the British Journal of Sports Medicine, which included nearly 12,000 Australian adults, concluded that each hour spent watching television after the age of 25 reduces your life expectancy by nearly 22 minutes (Mercola, 2012).

People need to be more understandable about the concept of CVS. It is not because of the CVS a person goes blind, it usually happens when we do the repetitive motion for longer periods of time. If no action taken it will lead to the near-sightedness or blindness. The prevention needs to be taken in order to make sure that we are in a good health condition. People can take some rest before they continue sitting in front of the computer screen. New science shows very persuasively that standing up about every 20 minutes, even for only a minute or two, reduces your risks of developing diabetes and heart disease (Kevan, 2014). If there is no prevention taken, the person might be having a serious health problem.

2.4 Work-related Musculoskeletal Disorders (WMSD's)

Musculoskeletal Disorders or MSDs are injuries and disorders that affect the human body movement or musculoskeletal system for example muscles, tendons, ligaments, nerves, discs, blood vessels, etc.(Matt, n.d.). Usually office workers are the focus group for the WMSD's. This is because an office worker does not aware about the injuries that will happened due to their unawareness regarding ergonomics. WMSD's will happen if the employee already exceeds his or her body physical limitations. Normally, human body have the limitations to do some works that must be suitable with the health conditions. Work-related musculoskeletal disorders (WMSD) are conditions in which the work environment and performance of work contribute significantly to the condition and the condition is made worse or persists longer due to work conditions (Centers for Disease Control and Prevention, 2013).

In 2001, service industries reported the highest proportion of WMSDs (25.8% of WMSD cases), followed by manufacturing industries (22.9% of WMSD cases) (Ann E. Barr, 2004). Most of the injuries happened in the working environment is due to the WSMD's. Higher management have to bear to cost of treatment for their employees. Based on *Office Ergonomics* published in 2002, the single largest class of injury claims in the office are Work-related Musculoskeletal Disorders (WSMD's), which account for over 40% of all Washington State Fund workers' compensation claims among office workers (WISHA Services Division, 2002). According to the same research, these injuries result in medical and time losses costs of over $21 million per year to State Fund employers, and are responsible for over 70,000 lost work days per year (WISHA Services Division, 2002).

Working for prolonged periods in a standing position can cause sore feet, general muscular fatigue, and low back pain (Canadian Centre for Occupational Health & Safety, 2015). The symptoms that are comes from WSMD's are discomfort, pain, fatigue, swelling, stiffness and numbness and tingling. Our psychosocial factors in the working environment also will lead to WSMD's. It is very important to take care our physical body and psychosocial with working environment. The example of psychosocial is the mental strain that can result a muscular tension towards on the body. When there are tight deadlines workers have

to make sure that their tasks finish on time, workers will be having a psychosocial at their workplace.

According to the research paper *European Agency for Safety and Health at Work*, the factors that contribute MSDs are categorized to different group of factors such as physical or biochemical work-related factors, organizational or psychosocial work-related factors, individual or personal factors and factors relating to social content (European Agency for Safety and Health at Work, n.d). Based on previous literature, there many others factor that will contribute to WMSD's. This project will be focusing on the work-related issues that happen in the working environment.

Physical factors include the work procedures, equipment and environment that lead to biomechanical stress in the muscles, tendons, spinal discs and nerves (European Agency for Safety and Health at Work, n.d.). By doing repetition motions continuously it can result in trauma to the joints and surrounding tissues in our body. As example, too much typing at the keyboard, moving and clicking the mouse, looking back and forth between monitor and documents by continuously doing the same activity it will result to having a WMSD's. According to the research by *Canadian Centre for Occupational Health and Safety* are saying that some researchers classify a job as "high repetitive" if the time to complete such a job was less than 30 seconds or "low repetitive" if the time to complete the job was more than 30 seconds (Canadian Centre for Occupational Health & Safety, 2015). When the workers are doing repetitive motion, they will feel very tiring because there is no time for them to stop and having a rest.

Based on the Office Ergonomics published in 2002, one of the risk factors that have increased in the computerized office is static loading, where the muscles must hold the body in a single position for a long period of time (WISHA Services Division, 2002). If muscle is tensed, it then can contribute to aggravate an injury. All the injuries will happen if the factors of static loading are continuously replied applied for a longer period of time. As example, holding hands in place above the keyboard or mouse, holding the Shift key, keeping the head still while reading from the monitor and sitting for long periods of time. An office worker needs to remember that they have to make sure that they are sitting with a back support.

Another factor that can contribute to the WMSD's is awkward posture. In awkward postures (with the hands above shoulder height or with the wrists noticeably bent) the joints are more susceptible to injuries and the muscles have less capacity for exerting force (European Agency for Safety and Health at Work, n.d.). When performing the postures that bend the joints it will contribute the awkward postures. When our joints get into the position, the contracted muscles squeeze the blood vessels so that our blood flow will be restricted. There are many activities that can contribute to the awkward postures while performing a job tasks. For example, working with the torso bent forward, backward or twisted can place too much stress on the low back, stressful body positions include reaching above shoulder level, reaching behind the body, rotating the arms, bending the wrist forward, backward, or side to side, and reaching forward too far out in front of the body (Canadian Centre for Occupational Health & Safety, 2015).

Next factors is the force, while doing daily jobs we require some amount of force that we need to apply by very small muscles, which can lead to fatigue, swelling, muscle strains and ligament strain (WISHA Services Division, 2002). The examples of force are gripping the sides of the mouse tightly, dragging and dropping with the mouse and pounding on the keyboard. The amount of force we use to do a job depends on many factors such as the weight of the objects and their placement in relation to the body (Canadian Centre for Occupational Health & Safety, 2015). If too much force being put on the job task, it will result to WMSD's.

Musculoskeletal disorders are associated with high costs to employers such as absenteeism, lost productivity, and increased health care, disability, and worker's compensation costs (Centers for Disease Control and Prevention, 2013). If no prevention steps taken WMSD's may even worst time by time and it will become more costly to treat the employees. Employees that are having WMSD's will be resting for a longer periods of time.

2.5 Correct Utilization of Break Time

Physical activity or exercise can improve our health and reduce the risk of developing several diseases like type 2 diabetes, cancer and cardiovascular disease (Better Health Channel, 2015). Exercise will lead us to a healthier lifestyle and make our day become more energetic. Life quality will be improved by exercising

consistently. Exercise also can help to reduce depression and blocks all the negative thoughts. Exercise may also induce change of chemical level inside the brain, such as serotonin, endorphins and stress hormones (Better Health Channel, 2015).

Mind and body require a break after certain period of time. It is important for the office workers to take a break for a while after doing some jobs. Rest is an important part of a healthy lifestyle for all ages because it rejuvenates body and mind, regulates mood, and is linked to learning and memory function (UW CareLink, n.d.). In contrast, if workers are not getting enough rest it can affect their mood, immune system and stress level. Correct utilization of break can improve productivity and can lead to a much more creative idea generation.

A research published in the Journal of Epidemiology and Community Health showed that short bouts of exercise helped lower blood pressure as well as shave inches off the hips and waistline (Colette Bouchez, 2010). Workers can find some time to do an exercise in front of their computer screen for at least five minutes a few times a day. Some of these exercises can fit into a 5-minute time period at work, at your desk, waiting on line in the grocery store, even while driving a car (Shina, 2010). This exercise will be beneficial to all workers that implement a healthy lifestyle.

Frequent breaks are more satisfactory than occasional or longer breaks for example a 5-10 minute break after 50-60 minutes continuous screen and/or keyboard work is likely to be better than a 15 minute break every 2 hours (Health and Safety executive, n.d.). Every employee shall plan their activities at work so that they can have a good quality of work. Breaks must also allow users to vary their posture for example doing some exercise routines which include blinking, stretching and focusing eyes on distant objects can be helpful (Health and Safety executive, n.d.).

2.6 Existing Software to Remind User to Take a Break

Computer nowadays become a needed by all generation around the world. Most of the computer users are the officer and students. People are aware about the consequences of sitting in front of computer screen for longer periods of time but no action taken to prevent this situation from continuously occurring.

As a result, there are many software been developed in order to remind the user to take a break after sitting in front computer screen for longer period of time. Below are the examples of existing software that already exist:

Software Name	Description
Off4Fit	• This software will pause the users while they working and asking them to do some exercises. Users will do a stretching in front computer screen by following the video exercise that has been displayed on the computer screen. • User can set the time interval that they want to have between pauses which are 60 minutes ideally and the program will be running in the background until the break alarm goes off.
RSI Warrior	• This software will give a rest break reminders that are timed-based on how hard user actually work at the computer. • Users will be provided a time to briefly relax, regain awareness about their posture and work patterns. • Users need to follow the video exercise that been displayed while the program running.
Workrave	• This software will give a window pop-up at regular time intervals to prompt user to take a break after sitting in front of computer screen for longer periods of time. • It will alert users to take micro-pauses, rest breaks and restrict user to their daily limit. • This software runs on GNU/Linux and Microsoft Windows.
Scirocco Take A Break	• This software give a complete customization of work, break times and snooze, audio or visual notifications, type of timer displays, screen saver, locking mechanism of workstation on break, tray icons, and time spent statistic, average of break time per hour and also motivational pie chart.

Table 1: Example of Existing Software

Based on the table above, there are various software that already been exists to alert users to take a break after sitting in front of computer screen for longer periods of time. However, there are still people that are not aware about the existence of this software. Nevertheless, most of the software requires user to set all of the functionalities by themselves before they start using the software. But somehow, user will have the tendency to forget and postpone the break duration since they have an option either to lock the operating system or not.

CHAPTER 3

METHODOLOGY

3.1 Research Methodology

For the purpose of completing this project, the research methodology applied involves several processes. First, there are some interviews and observations about the ergonomic. From the interviews, people were asked on the awareness and not many of them are aware about what is ergonomics. Real concept has been explained to the sample. From the observation, most of office workers encountered problems in their working environment. Due to lack of knowledge about ergonomics this practices become common things for them. Secondly, previous report on the Computer Vision Syndrome (CVS) has been gone through. Thirdly, research about ergonomic have been done through internet.

Figure 1 below is the research methodology:

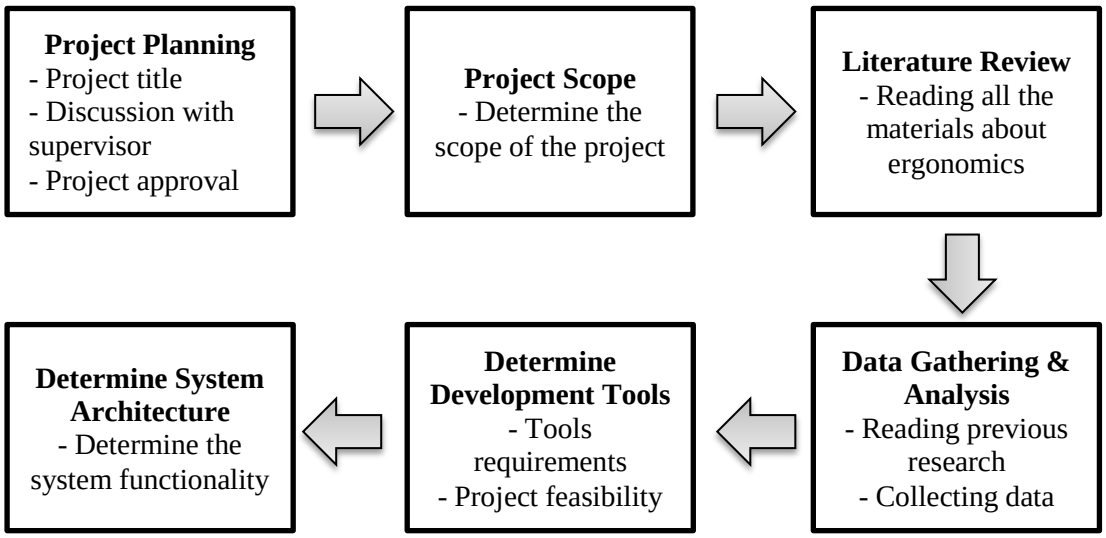


Figure 1: Research Methodology

3.2 Development Methodology

The development methodology used in this project is System Development Life Cycle (SDLC) method. SDLC methodology has been chosen for this project because it is really suitable with this system. This system is mainly on software configurations. All the phases have been included to develop this application.

The important things about SDLC is that, the documentation allows to trace back the business requirements needed if there are any changes or modifications made during the project development. SDLC also has many intermediate products that can be reviewed to see whether it meets the user requirements or not. With SDLC, error during testing phase can be traced the previous mistakes that I have made. This project is divided into six main phases as below:

Figure 2: System Development Life Cycle

- Requirements Analysis
- System Analysis and Design
- Code Generation
- Testing
- Implementation
- Maintenance

1. Requirements Analysis
    - All the requirements are gathered in this phase.
    - Requirements specification.
2. System Analysis and Design
    - Specifying the system requirements.
    - Defining the overall system architecture.
3. Code Generation
    - Writing on the code for this system.
4. Testing
    - System testing.
    - Monitoring and controlling.
    - Records the result.
5. Implementation
    - Final product.
    - Deliver the system to the users.
6. Maintenance
    - Monitor the system either its working or not.

3. 3 Basic System Architecture

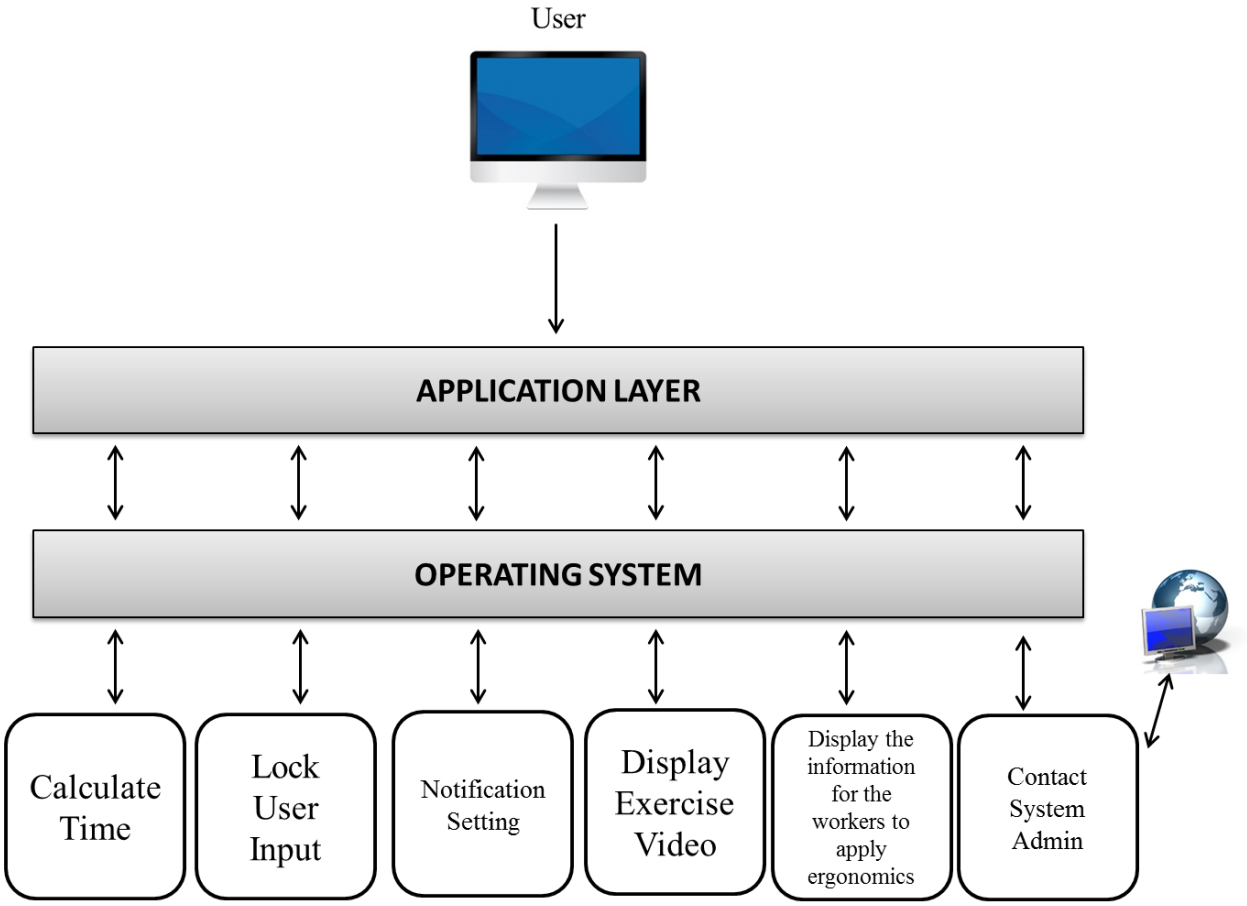


Figure 3: Basic System Architecture

3.4 Development Tools

Development tools used to develop this project are:

Hardware

- Personal computer to write and run coding.
- Computer runs in Windows Operating Systems.

Software

- Visual Studio 2013
    - For main coding and system development
    - Execute and run coding.

3.5 Gantt Chart

No.	Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Project Planning														
2	Introduction & Research														
3	Literature Review														
4	Data Gathering & Analysis														
5	Develop System Architecture														
6	Designing Interface of the System														
7	Submission of Interim Report & Proposal Defence														

Figure 4: Final Year Project 1 Gantt Chart

No.	Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Development & Prototyping														
2	System Testing & Monitoring														
3	Tabulate result and discussion														
4	Implementation														
5	Pre SEDEX														
6	Documentation														
7	Submission of First Draft Report Dissertation														
8	SEDEX														
9	Viva														
10	Final Submission of Dissertation														

Figure 5: Proposed Final Year Project 2 Gantt Chart

3.6 Project Milestones

For the project milestones it will shows the project deliverable duration also with the specific date in order to make this application.

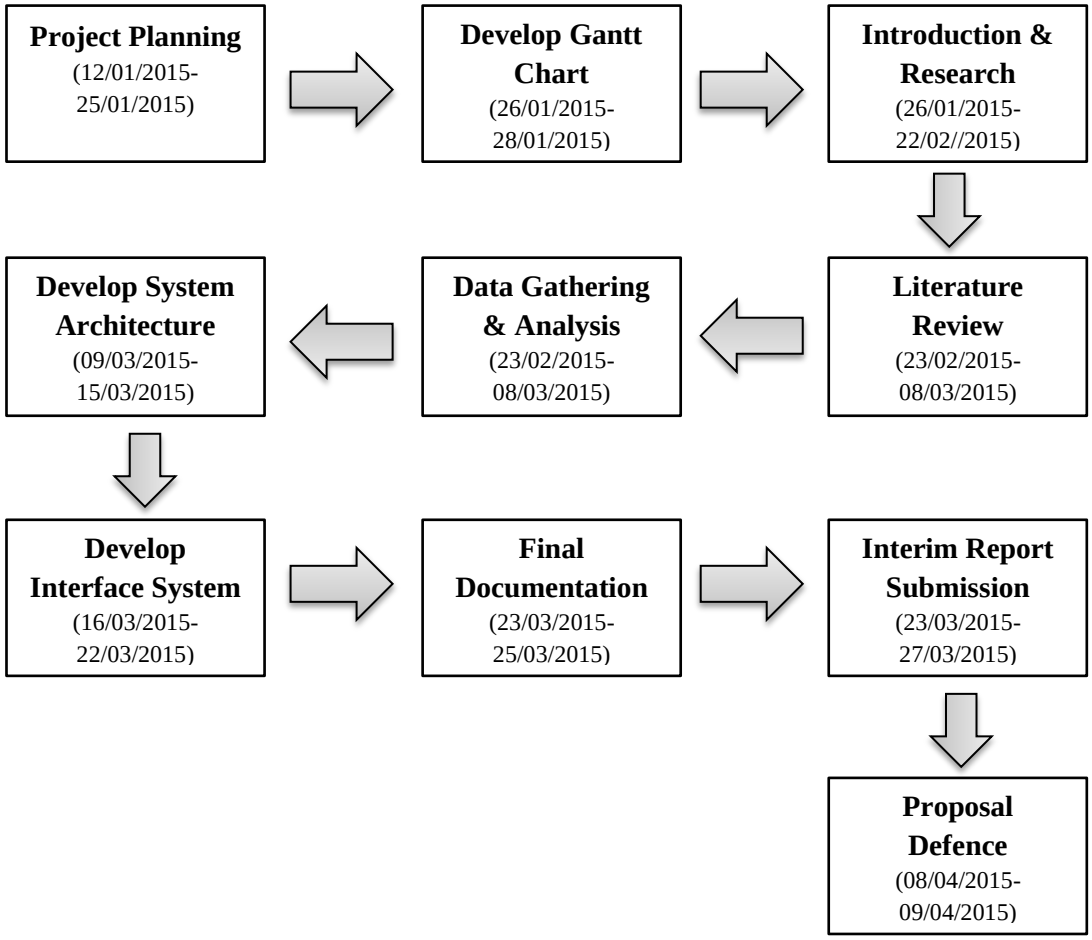


Figure 6: Final Year Project 1 Project Milestone

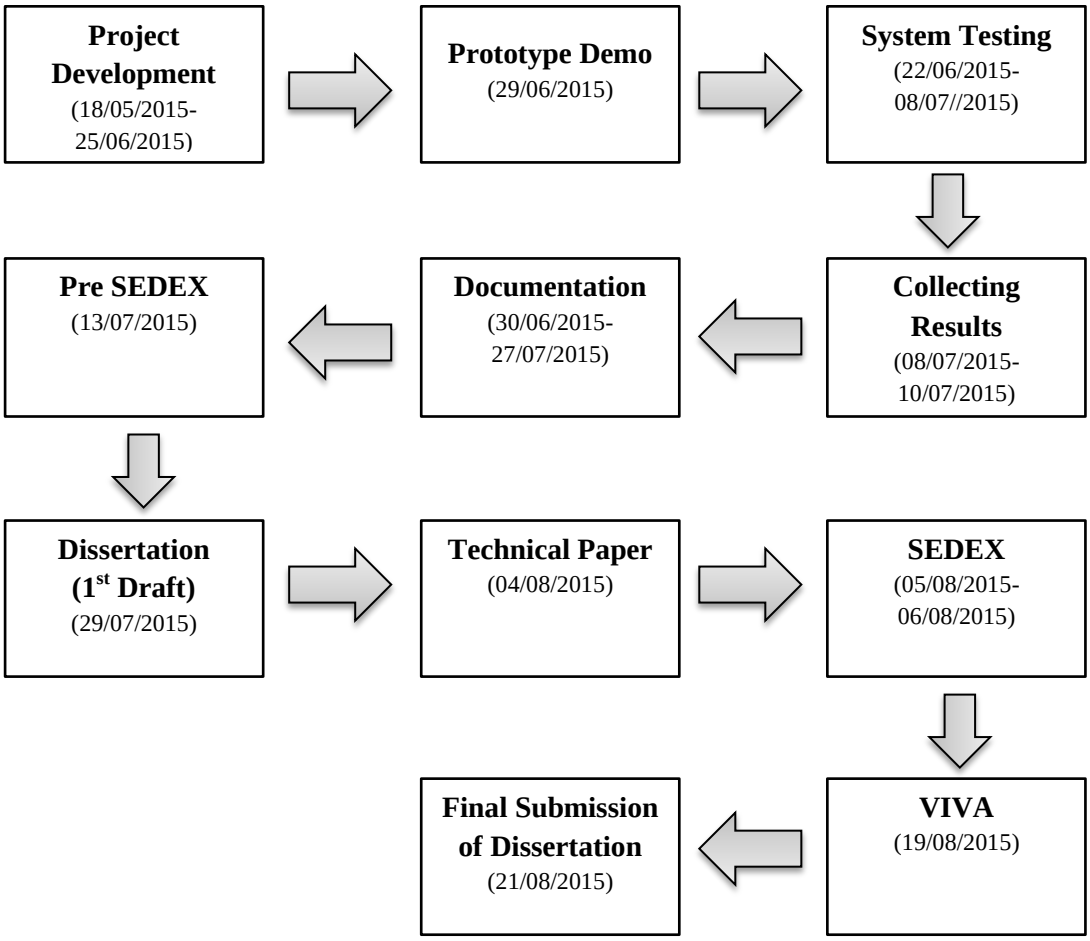


Figure 7: Final Year Project 1 Project Milestone

CHAPTER 4

RESULT AND DISCUSSION

The final prototype from the previous project is shown in this section. For the enhancement project, it will be added the new functionality for this system. The functionality that is going to be included for this system is an exercising video and information about the correct way for the workers to apply ergonomics in their workplace. The sketching of mock graphical use interface (GUI) and program flow chart are shown in this section.

4.1 Previous Project

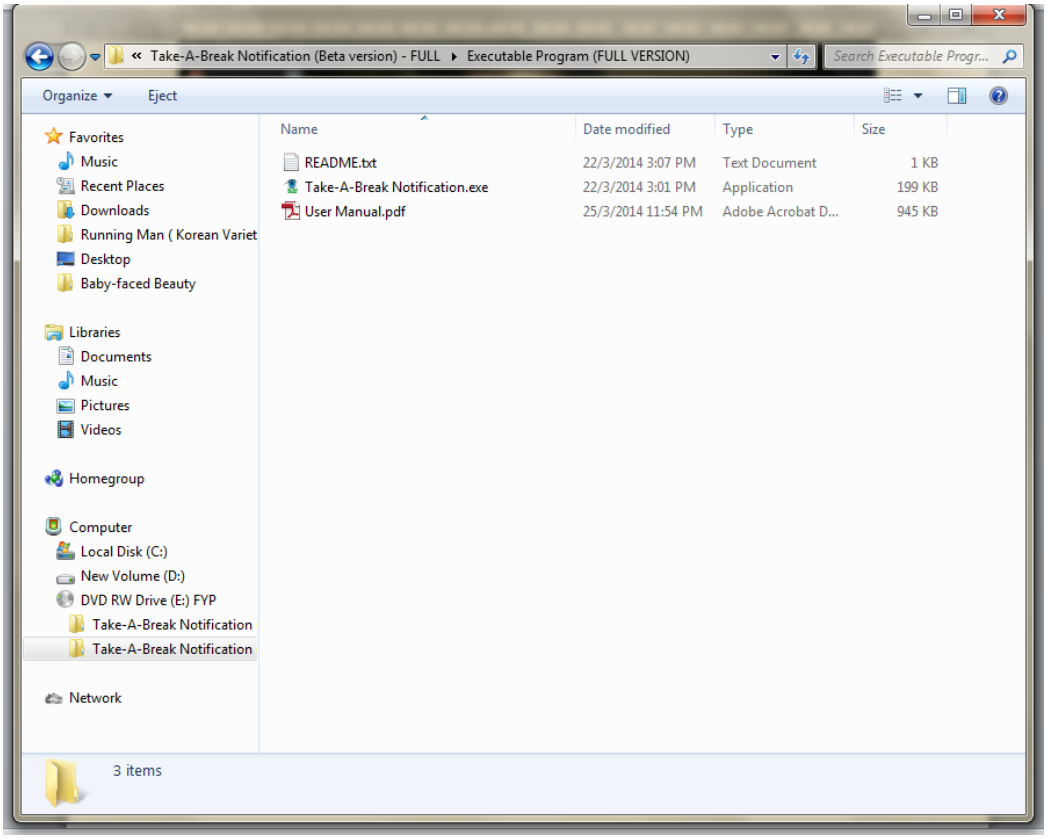


Figure 8: Copy Folder to C:\ directory

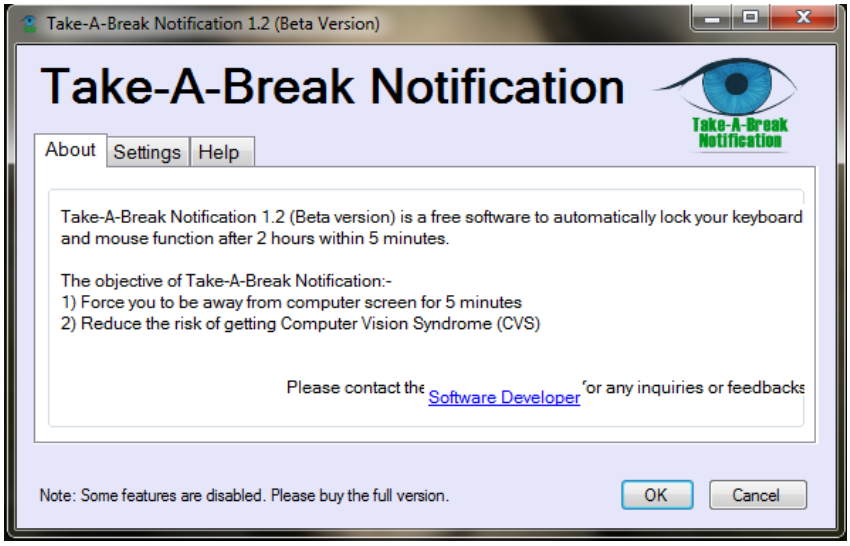


Figure 9: Screenshot "About" tab

This screen will be displayed after you click on the Take-A-Break Notification application. For the about tab it contains the overview of Take-A-Break Notification as well as the objectives of the software. As a user, they need to know what are this application doing, the importance and purpose by installing this application in their computer.

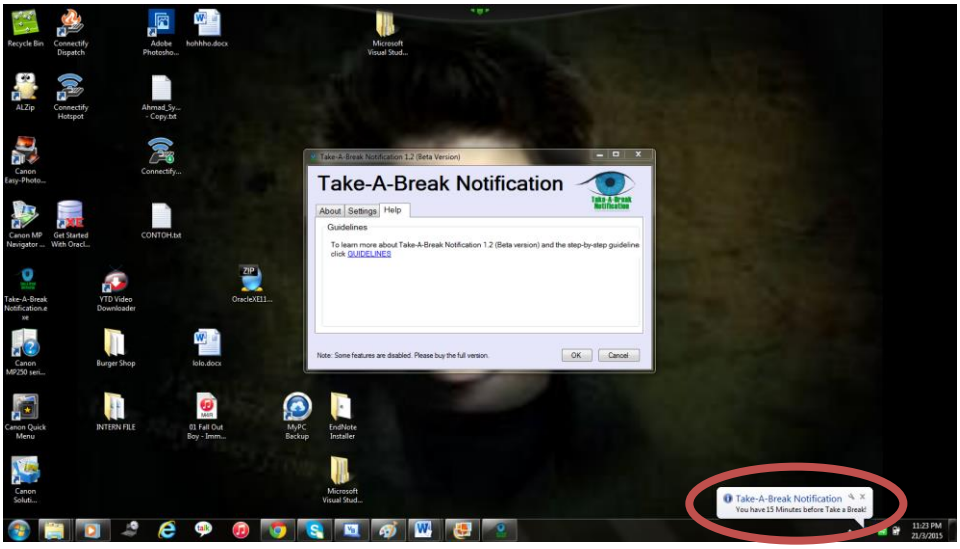


Figure 10: Screenshot Notification Popup from System Tray

The notification will be popup 3 times 15 minutes before the PC is locked for every 5 minutes interval. This reminder is for user to be aware to finish or complete their works.

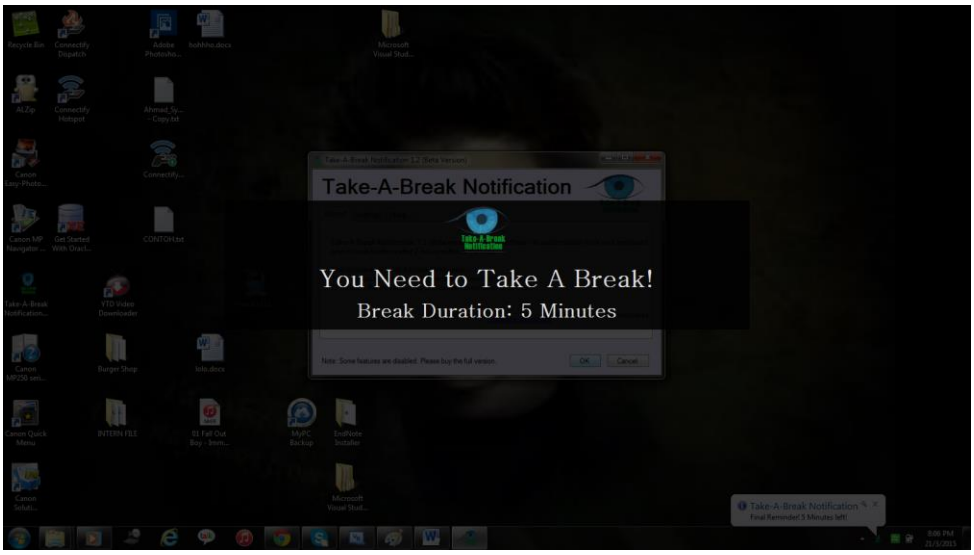


Figure 11: Screenshot of Dim Screen

During this phase, the keyboard and mouse functions are locked using Dim Screen for 5 minutes. User needs to be away from the PC to get some rest before they can continue with their works.

4.2 Enhancement Prototype

Figure 12: Exercise Video

After users are being notified to take a break, exercise video then will be displayed to the users. This exercise video will instruct users to do an exercise during the rest periods. the video will instructs users to do a basic stretches are suitable for the office workers that are sitting in front of the computer screen for longer periods of time.

Basically there are about 12 types of stretches in total, starting from hands and arms until working up to neck and back. Video will shows the instruction that users need to follow.

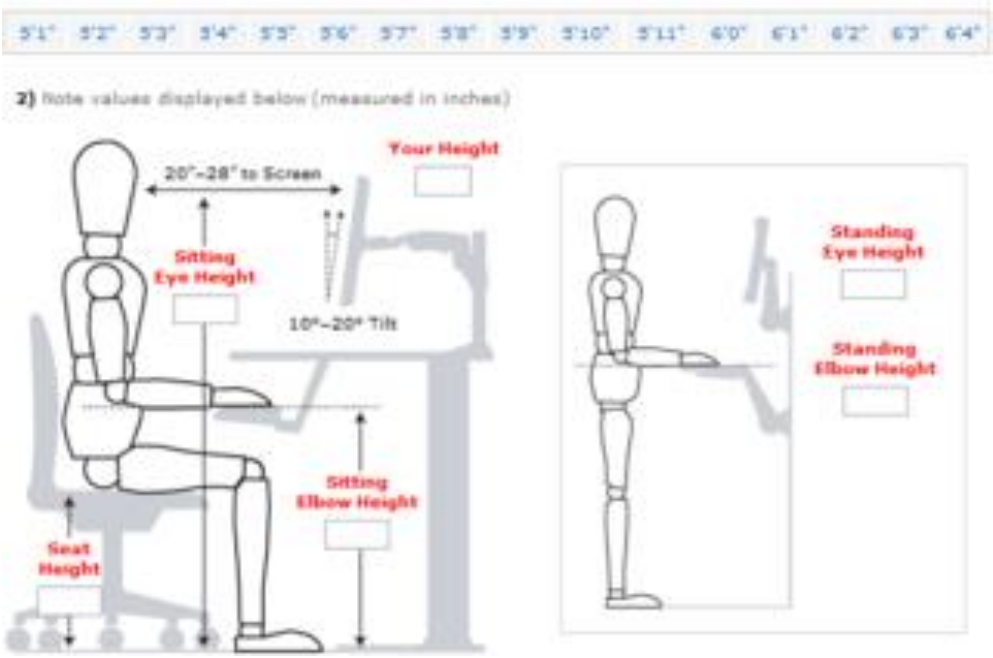


Figure 13: Information about the correct way for workers to apply ergonomics

After the video finish, this application will show to the user information about the correct way for workers to apply ergonomics. User will know about the correct way for them to sit in front of the computer screens. This picture will guide user the steps that they need to be taken for them to follow the correct way for them to apply ergonomics.

4.3 System Flow Chart

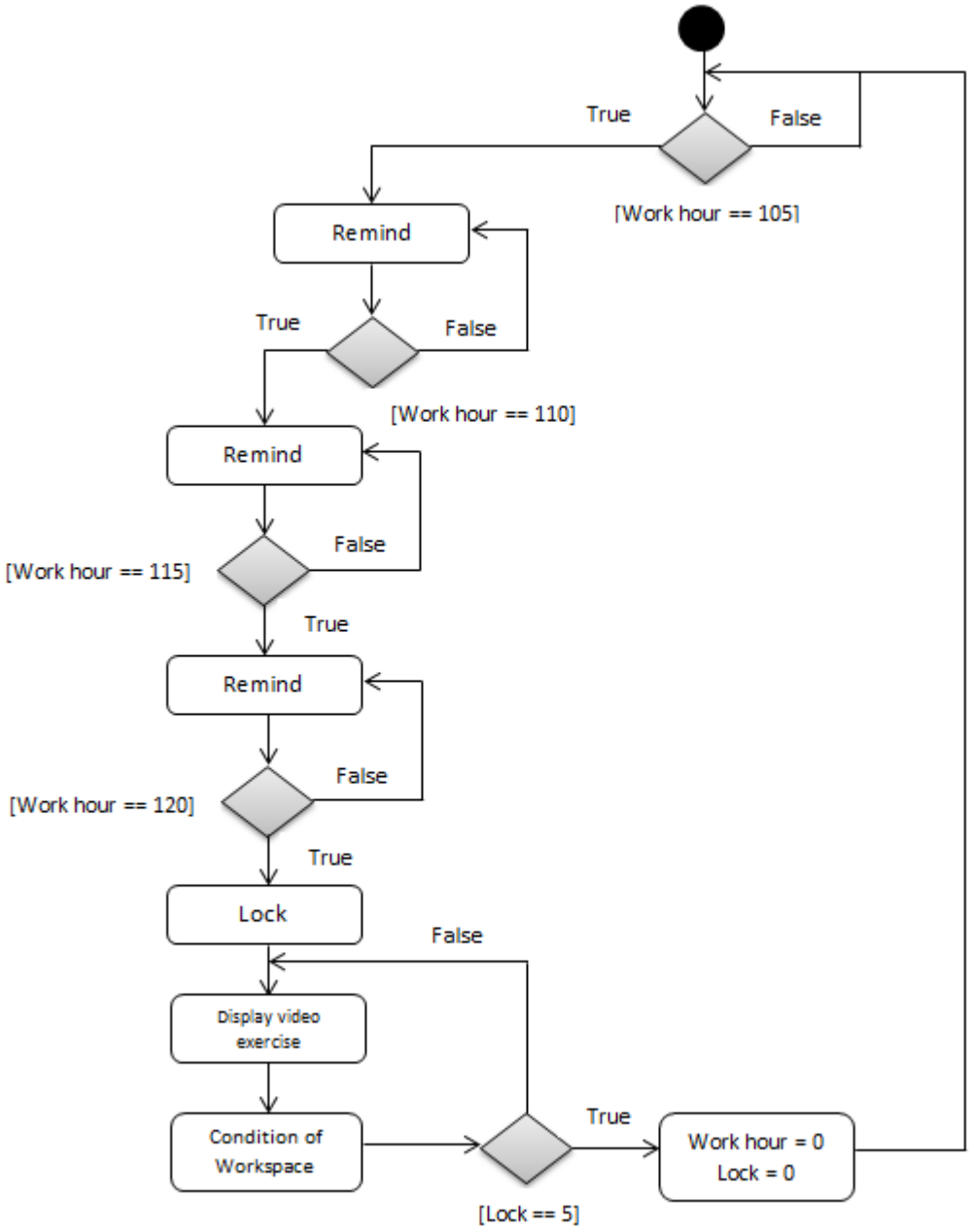


Figure 14: System Flow Chart

The above figure shows a flow chart that summarized the main components of Enhancement Take-A-Break Notification. First the application will check during the 105th minutes on time spent by the user in front of computer screen. If the condition is true, it will remind user as a first reminder. So the first reminder will be popup. After that, system will check continuously until the second reminder which is at 110th minutes. After the condition is true, it wills then popup the last reminder

which is at 115th minutes. During the 120th minutes, the Dim Screen will be displayed to the user and asked them to take a break for 5 minutes including with the video exercise and information about correct way to apply ergonomics in your workspace.

After user take a break, system timer will loop and return to zero values (*System Timer = 0 min, SystemLock = 0 min*) and the application will be restated from the beginning.

4.4 Final Prototype

This software runs on Windows operating systems. As for now, this software is not supported by other operating systems such as Linux and Apple. For this beta release it contains the main components as per mentioned in earlier section.

User need to copy Enhancement Take-A-Break Notification folder into Program Files in C:\ directory. Once the launcher icon from the program folder is clicked, the program will display "About" screen. This is where user will click the "OK" button and program will then starts. The prototype screenshots are shown below:

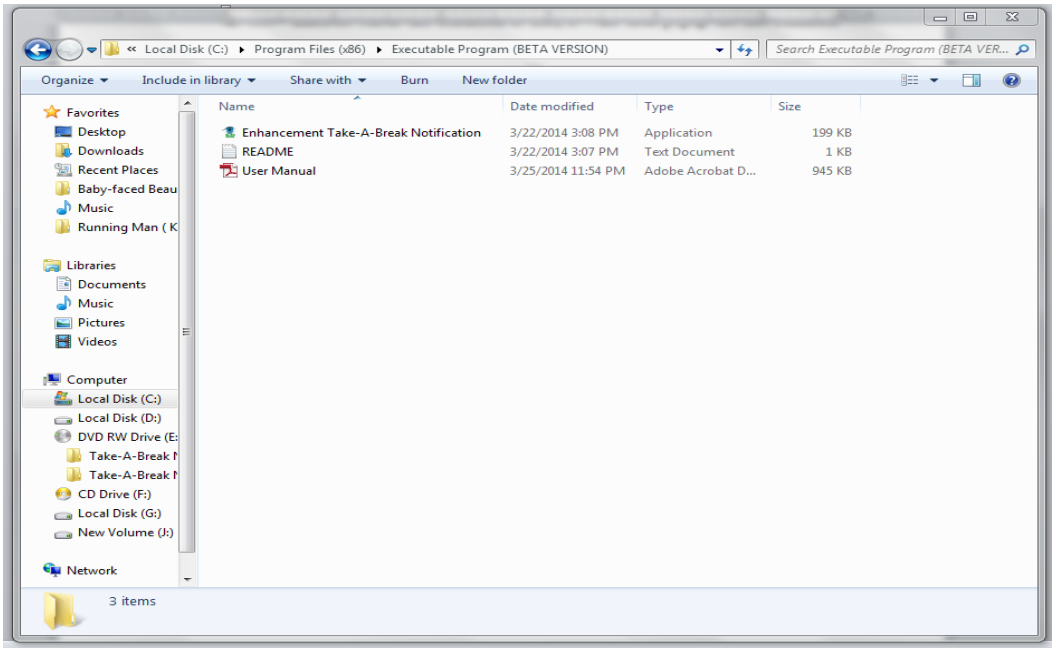


Figure 15: Copy Folder to Program Files (x86) C:\ directory

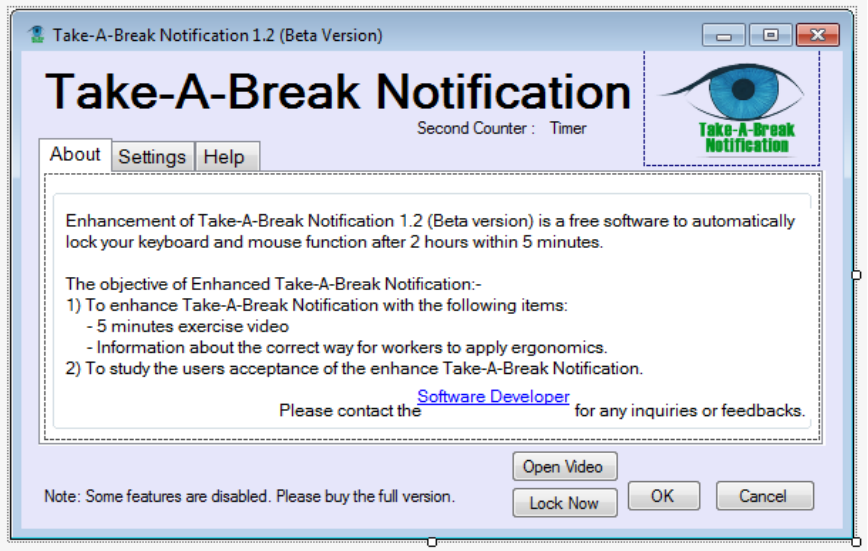


Figure 16: Screenshot "About" tab

About tab contains the overview of Enhancement of Take-A-Break Notification as well as the objectives of this software. Users can read the importance and purpose of the software implementation.

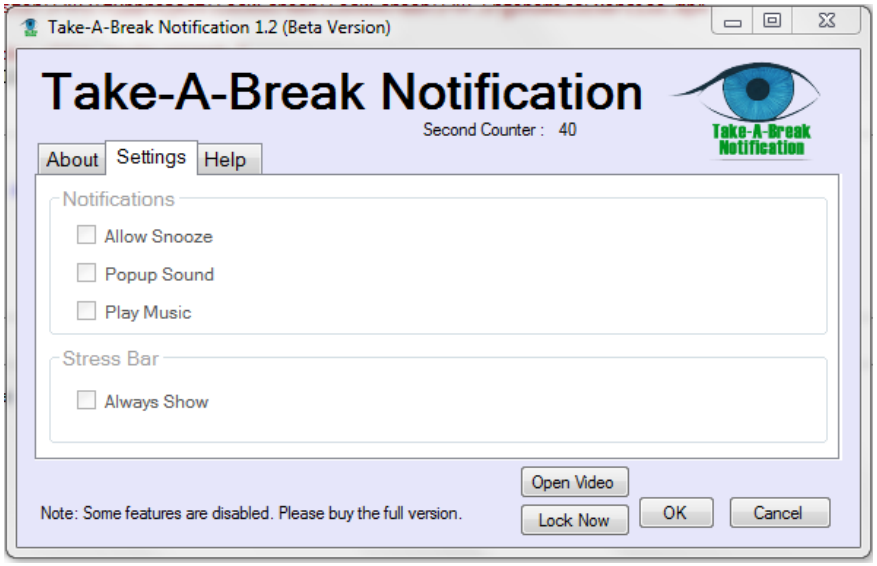


Figure 17: Screenshot "Settings" tab

For this settings tab future users will be provided with the complete version of the software. A few interactive features such as Popup Sound, Music Background and Stress Bar which is to indicate the period concentration before the computer is locked. This beta version is free software while the complete version users need to register and purchase from software developer.

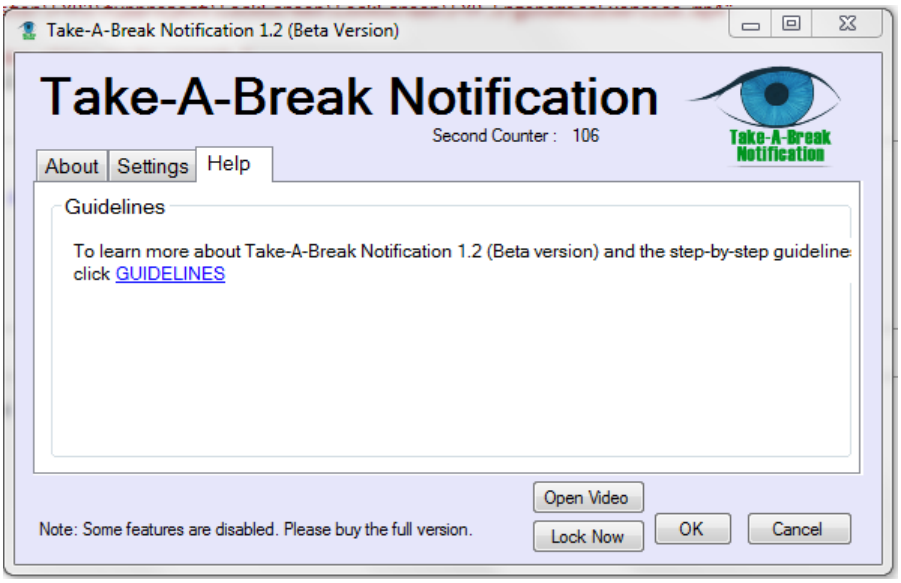


Figure 18: Screenshot "Help" tab

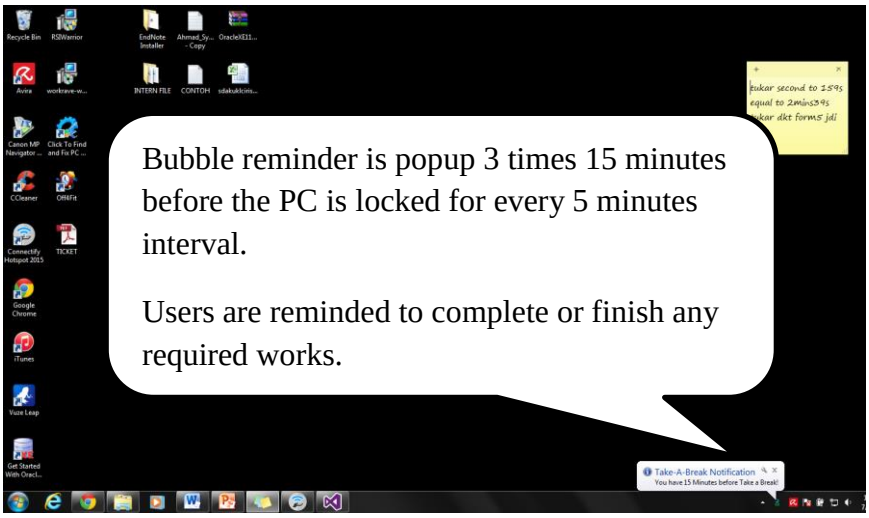


Figure 19: Screenshot Notification popup from System Tray

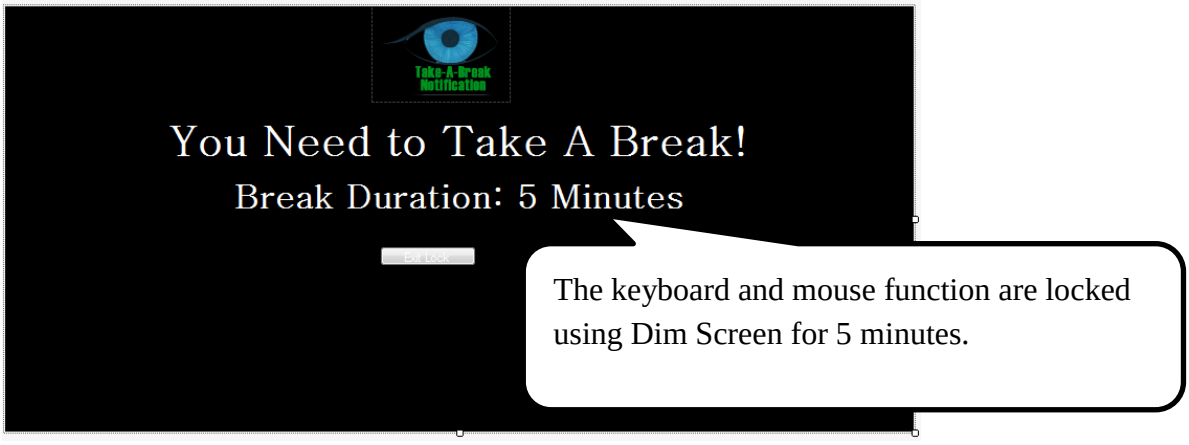


Figure 20: Screenshot of Dim Screen

Figure 21: Screenshot of Exercise Video

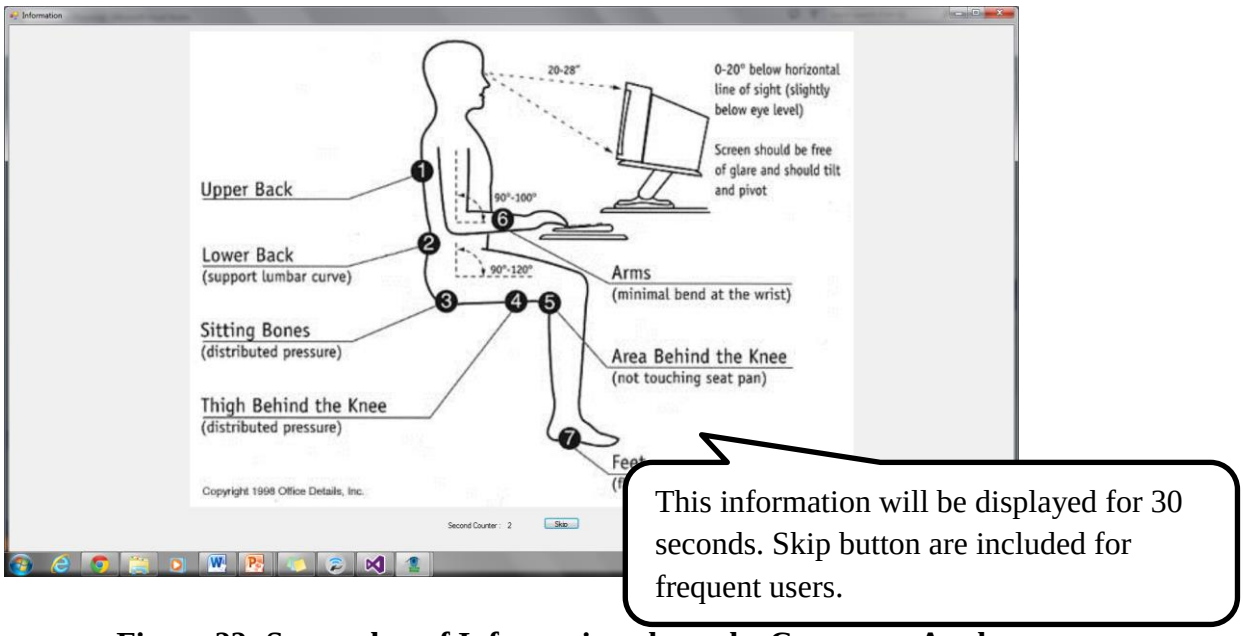


Figure 22: Screenshot of Information about the Correct to Apply Ergonomics

4.5 Survey Data Collection & Findings

During the final development phase of this project, there are two type of tests that are being conducted; (1) unit testing and (2) usability testing. For the unit testing it also known as software testing method and conducted based on white-box technique. The reason for this unit testing be conducted is to ensure that the program meets its objective. During unit testing being conducted it is not involving the target users. For this unit testing each unit is tested separately before integrating them into modules to test the interfaces between modules. In the meantime, the usability testing was conducted on 3 office workers and 2 students. Results for this testing will be explained in the next section.

4.5.1 Unit Testing

Unit testing will searches for defects and verifies the functioning of the software. Each module was tested separately in order to verify the functionalities are working and few defects will be fixed immediately as they were found during testing phase.

There are fourteen (14) units or components used in the software:

1. Timer
2. Dim Screen
3. Notify Icon
4. Minimize to icon tray
5. Double click on icon to open
6. “OK” button
7. “Open Video” button
8. “Lock Now” button
9. “Cancel” button
10. Contact “Software Developer”
11. View “User Manual”
12. Exercise Video
13. Picture of information about the correct way to apply ergonomics
14. “Skip” button

The main functions of Enhancement of Take-A-Break Notification are its timer, Dim Screen, Exercise Video and picture of information about the correct way to apply ergonomics. The user keyboard and mouse will be disabled and Dim Screen will be activated after 2 hours of computer uses within 5 minutes. During this 5 minutes exercise video will be displayed followed by the picture of information.

Several test cases being simulated for the purpose of beta testing phase:

Test case:

Timer will be counted 7200 seconds. Therefore, for the purpose of beta testing, the Timer duration is set to 235 seconds before the Dim Screen is activated to show whether the timer looping and calling dim screen functions are working properly.

Main Components	Actual Duration	Test cases (duration as in Beta testing phase)
Timer	120 minutes: (7200 seconds)	35 seconds
Dim Screen	5 minutes: (300 seconds)	240 seconds
Exercise Video	2 minutes and 39 seconds: (159 seconds)	159 seconds
Picture	1 minutes: (60 seconds)	30 seconds

Table 2: Test Cases of Main Components

There are three (3) popup reminders at specific duration (th) as per shown below;

Popup Reminder	Actual Duration	Test cases (duration as in Beta testing phase)
1st	105th minutes: (6300 seconds)	210 seconds
2nd	110th minutes: (6600 seconds)	220 seconds
3rd	115th minutes: (6900 seconds)	230 seconds

Table 3: Test Cases of Popup Reminder

Technique Used:

Simulate the real duration of system timer and dim screen functions. Duration of each component/function has been reduced to increase the efficiency while conducting unit testing as shown below:

```
0 references
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs) _
    Handles Button1.Click

    Me.WindowState = FormWindowState.Minimized
    Me.Visible = False
    NotifyIcon1.Visible = True

    Me.Timer1.Interval = 1000  '1 Second interval
    Me.Timer1.Enabled = True 'Start Timer

End Sub
```

Test Case 1: "OK" button to start system timer

```
0 references
Private Sub Timer1_Tick(ByVal sender As Object, ByVal e As EventArgs) Handles Timer1.Tick
    Dim myObj As abcLockScreen = New abcLockScreen
    SecondCount += 1  'Add another second to the Count of Second
    lblTimer.Text = SecondCount

    'Check whether Counted 10 seconds or not
    If SecondCount = 210 Then '10 seconds, 105th minutes : 6300 seconds / 15 minutes before locked
        NotifyIcon1.Visible = True
        NotifyIcon1.ShowBalloonTip(3000, "Take-A-Break Notification", _
        "You have 15 Minutes before Take a Break!", ToolTipIcon.TTI_INFO) 'Popup 1st Reminder

    ElseIf SecondCount = 220 Then '20 seconds, 110th minutes : 6600 seconds / 10 minutes before locked
        NotifyIcon1.Visible = True
        NotifyIcon1.ShowBalloonTip(3000, "Take-A-Break Notification", _
        "You have 10 Minutes before Take a Break!", ToolTipIcon.TTI_INFO) 'Popup 2nd reminder

    ElseIf SecondCount = 230 Then '30 seconds, 115th minutes : 6900 seconds / 5 minutes before locked
        NotifyIcon1.Visible = True
        NotifyIcon1.ShowBalloonTip(3000, "Take-A-Break Notification", _
        "Final Reminder! 5 Minutes left!", ToolTipIcon.TTI_INFO) 'Final popup then only break
    ElseIf SecondCount = 235 Then 'Hit the timer, 120th minutes : 7200 seconds
        myForm = New Form4
        myForm.Close()
        Me.Timer1.Enabled = False
        myObj.LockSystemAndShow(Form2)
        SecondCount = 0
        Timer1.Enabled = True
    End If
End Sub
```

Test Case 2: Check the conditions of system timer

```
0 references
Private Sub Timer1_Tick(sender As Object, e As EventArgs) Handles Timer1.Tick
    SecondCount += 1  'Add another second to the Count of Second

    'Check whether Counted 10 seconds or not
    If SecondCount = 240 Then '240 seconds, Dim Screen for 5 minutes : 300 seconds
        Me.Timer1.Enabled = False
        SecondCount = 0
        bolExit = True
        Me.Close()
        openVideoForm()
    End If
End Sub
```

Test Case 3: To set the Dim Screen duration

```
0 references
Private Sub Form4_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load
    Me.Timer1.Interval = 1000
    Me.Timer1.Enabled = True
    assignVideoFile()
    playVideo()
End Sub

Dim SecondCount As Integer = 0
0 references
Private Sub Timer1_Tick(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Timer1.Tick
    SecondCount += 1
    lblTimer.Text = SecondCount
    'Tukar second nie utk set video form close
    If SecondCount = 159 Then 'video duration 2mins 39s 159s
        Me.Timer1.Enabled = False
        SecondCount = 0
        Timer1.Enabled = True
        Me.Close()
        openPictureForm()
    End If
End Sub
```

Test Case 4: To set Exercise Video duration

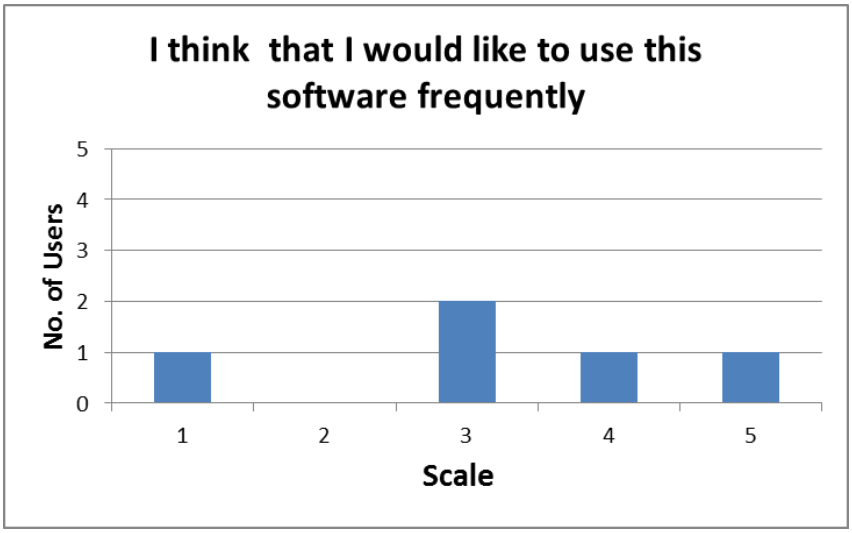
```
0 references
Private Sub Timer1_Tick(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles Timer1.Tick
    SecondCount += 1
    lblTimer.Text = SecondCount
    'Tukar second nie utk set picture form close
    If SecondCount = 30 Then 'actual 1 mins (60s)
        Me.Timer1.Enabled = False
        SecondCount = 0
        Timer1.Enabled = True
        Me.Close()
    End If
End Sub
```

Test Case 5: To set the Information about the Correct Way to Apply Ergonomics

4.5.2 Usability Testing

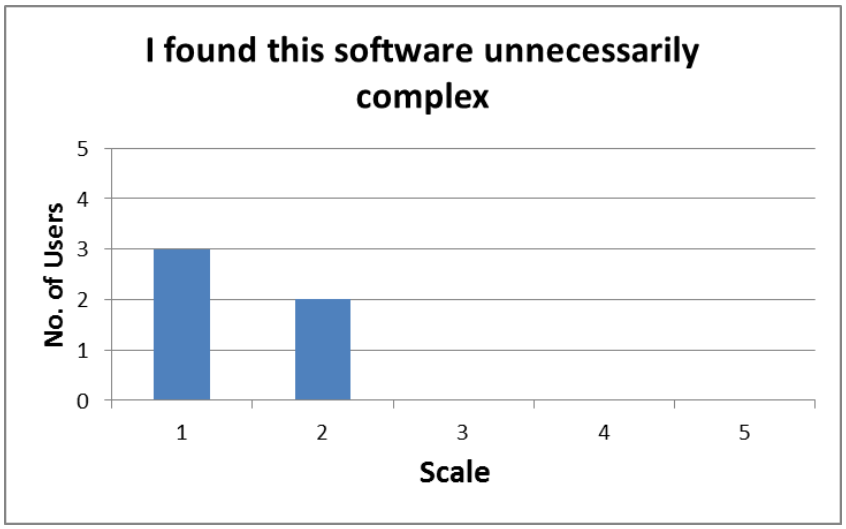
The usability aspects of the software were measured by using System Usability Scale (SUS) standard. Users are required to fill up a questionnaire after using the software. In order to answer the questions, users need to select based on point scale 5 ranging from “Strongly Agree”, 4 “Agree”, 3 “Neutral”, 2 “Disagree” and 1 “Strongly Disagree”. All results of the usability testing are shown below:

Question 1: I think I would like to use this software frequently.



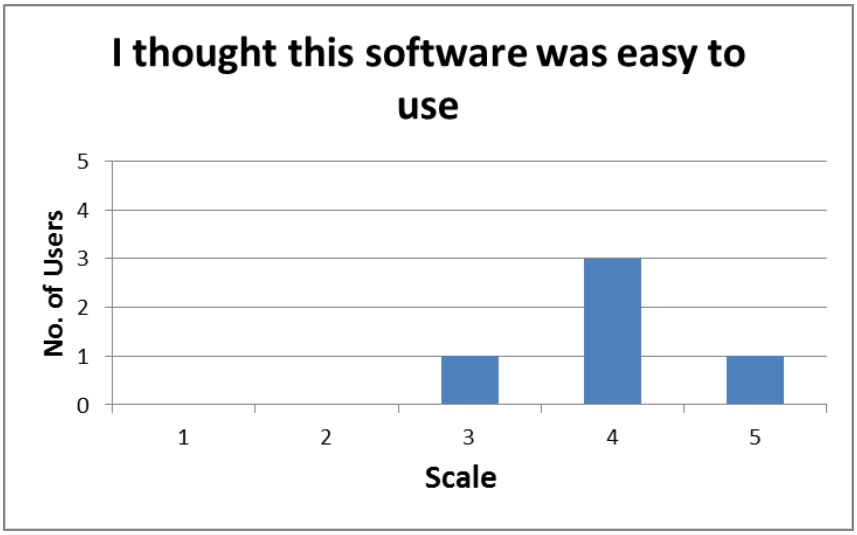
This has shown that 60% of the users agreed they would like to use the software.

Question 2: I found this software unnecessarily complex.



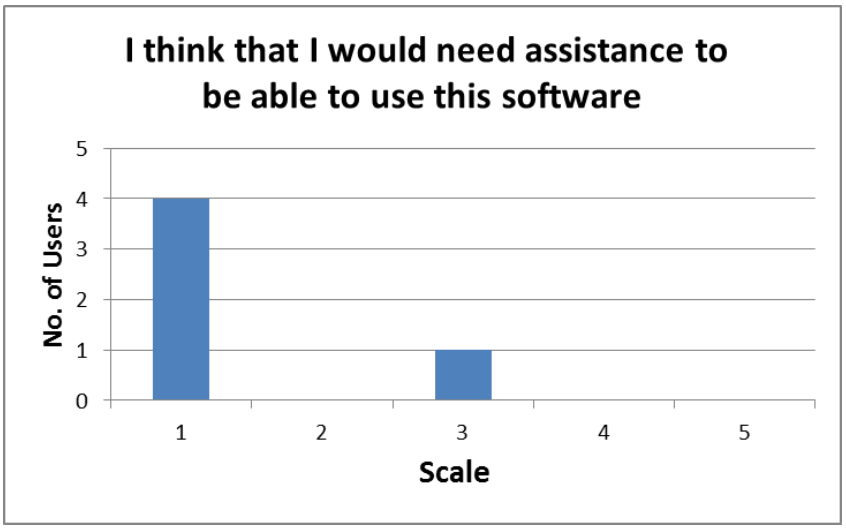
This shows that most of the users do not think that the application in unnecessarily complex.

Question 3: I thought this software was easy to use.



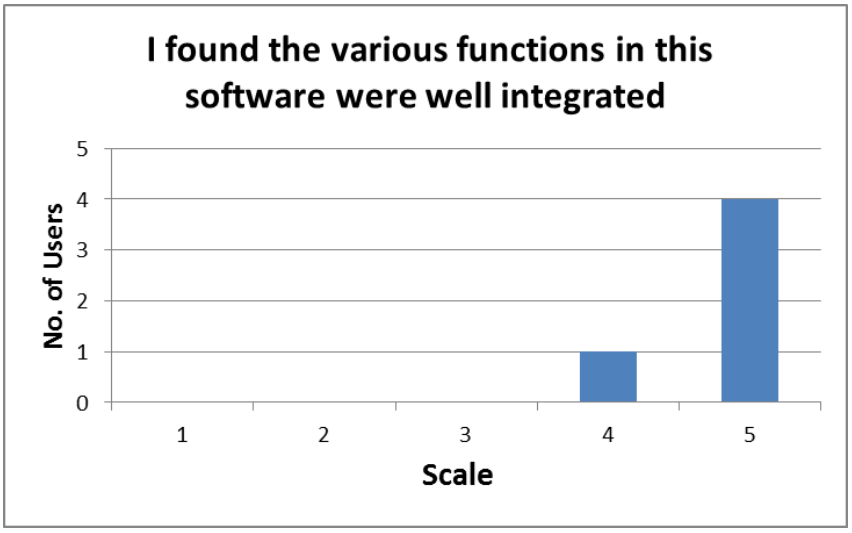
This shows that the users think that the application was easy to use.

Question 4: I think that I would need assistance to be able to use this software.



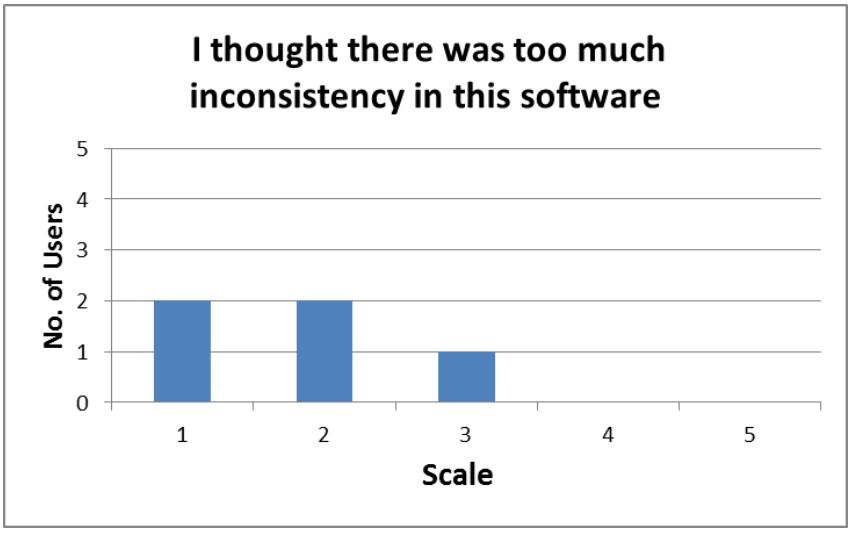
This shows that the users did not quite need any assistance from an experience person to use the application.

Question 5: I found the various functions in this software were well integrated.



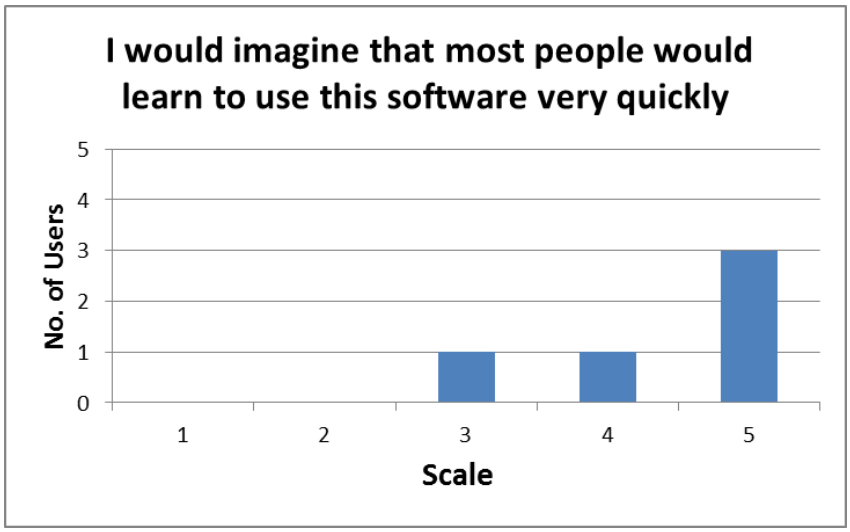
Based on this graph, it shows that the functionalities inside the application are well integrated.

Question 6: I thought there was too much inconsistency in this software.



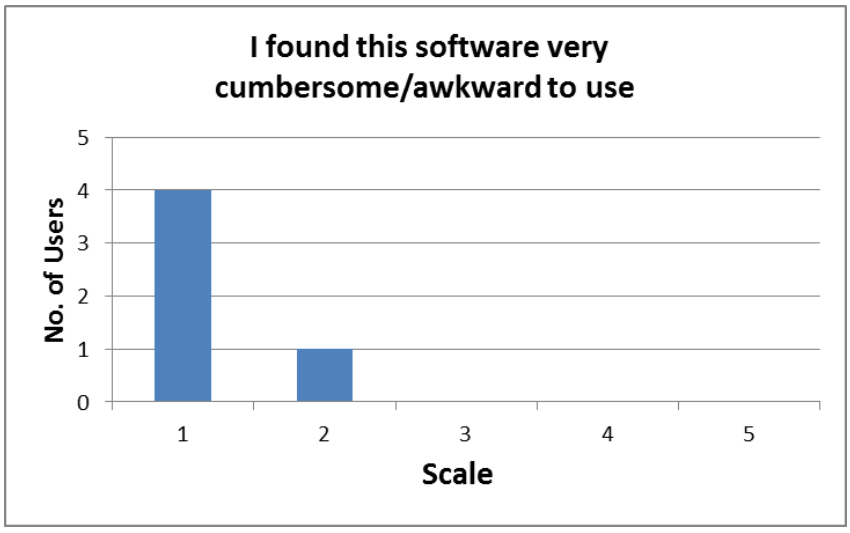
This shows that not half of the users think that the consistency in the application is good, while the rests thinks there is some inconsistency.

Question 7: I would imagine that most people would learn to use this software very quickly.



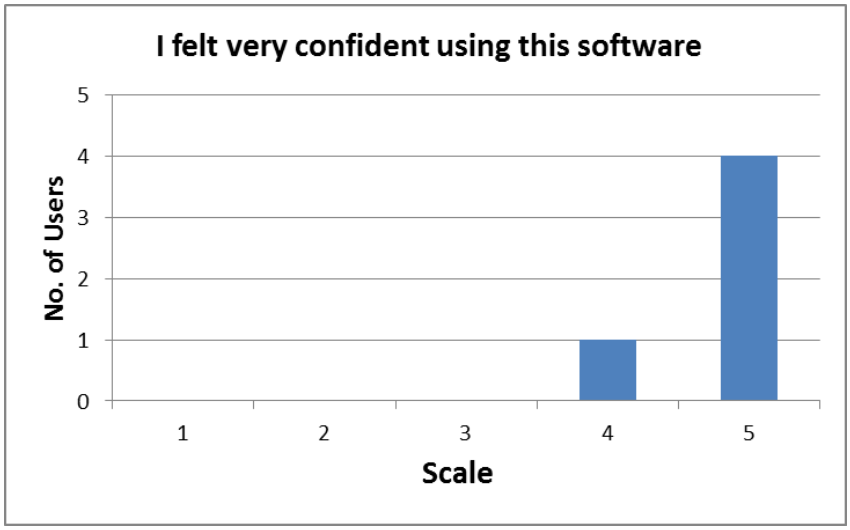
Based on this graph, it indicates that almost all of the users think that people will learn to use the application quickly.

Question 8: I found this software very cumbersome/awkward to use.



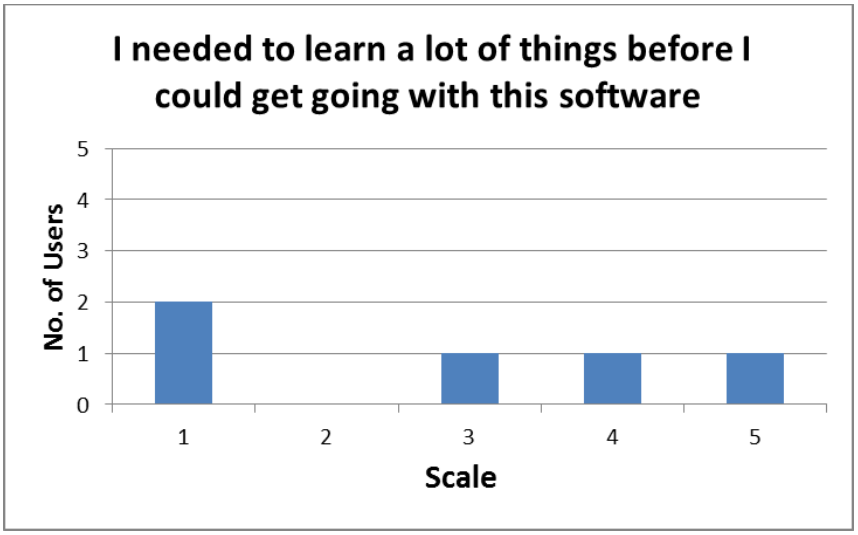
This shows that over half of the users think that the application is not cumbersome to use at all.

Question 9: I felt very confident using this software.



Based on the graph, it shows that most of the user felt confident to use this software.

Question 10: I needed to learn a lot of things before I could get going with this software.



For the last question, it shows that some of the users still think that they have to learn a lot of thing before they could get going with this application.

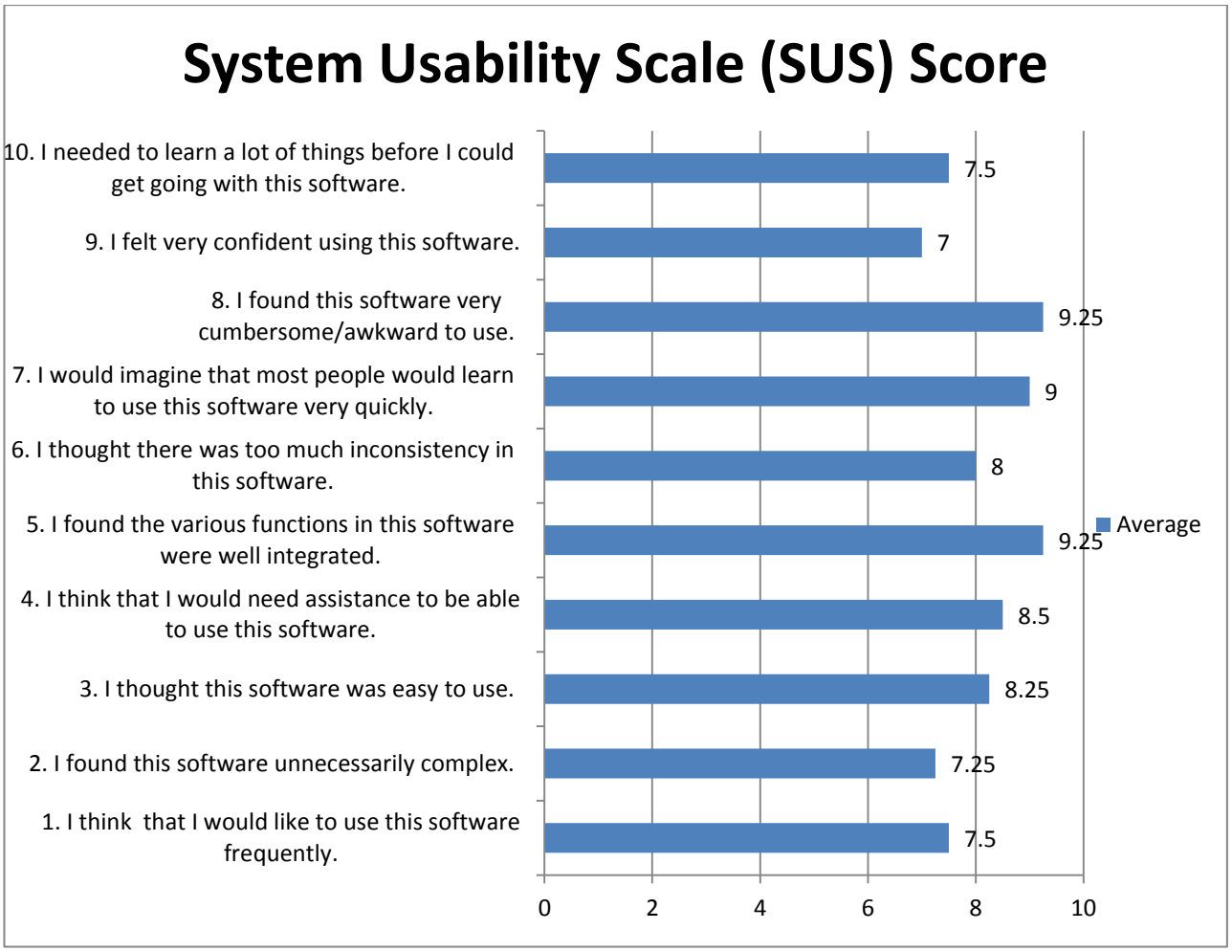


Figure 23: Average Score of Each Item based on SUS Survey

The figure above shows the average score for each of the question, from a total of five users. The calculation to obtain average scores for odd-numbered (1, 3, 5, 7 and 9) questions differ from the average scores for the even-numbered (2, 4, 6, 8 and 10) questions. This is because question 1, 3, 5, 7 and 9 expect users to rate more towards the higher side of the scale which 3 to 5 to achieve better usability testing, while question 2, 4, 6, 8 and 10 expect opposition (Sauro, 2011).

Below are the formulas to obtain average scores based on the questionnaire outcome:

Odd-numbered questions
Average score = [No. of Users * (Scale Position – 1) * 2.5 / Total No. of Users
Even-numbered questions
Average score = [No. of Users * (5– Scale Position) * 2.5 / Total No. of Users

Therefore, the total score for System Usability Scale (SUS) of Enhancement Take-A-Break Notification obtained from the five users is shown below:

SUS = Sum of Average Score for all 10 questions;

Sum of Average Score = 7.5 + 7.25 + 8.25 + 8.5 + 9.25 + 8 + 9 + 9.25 + 7 + 7.5

= 81.5, SUS Score obtained > 80 (Attaining Grade A)

Based on the SUS score, Enhancement Take-A-Break Notification obtained score above 80 which is considered as attaining grade A in the usability standard. The high usability quality of this software has proven that it is applicable for non-technical users which may find difficulties in using and configuring new implemented software or system.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

As a conclusion, the number of injury happens in the working place can be reduced by installing this application. All the communities in the working area will feel safer and more comfortable while working. This application will create safety awareness among the employees. Health, Safety and Environment (HSE) department can train and encourage employees to install this software to their computer. The quality of jobs will also be increasing since the employees get a chance to rest for a moments instead of working for extended periods.

By applying this application, both sides either organization or employees will get a beneficial results. For the organization, they can reduce of medical treatment expenditure. For example if there is an incident occurs, the management needs to pay hospital bills, medicine and etc. If the employees need to rest at their home, management need to find another part-time employee to do unsettlement jobs. There is indirect cost that we might not notice. Indirect cost can be up to twenty times of direct cost of an incident.

For the workers, they will feels more healthy and energetics since they have a good work life balance. In addition, ergonomics can reduce absenteeism by employee are free from sickness and this will resulting in more engaging and more productive towards their job. Workers will be more comfortable while doing their job; a lot of creative ideas will be generated since the employees are in a good health.

5.2 Recommendations

Since this application is only running on the Windows Operating System, another enhancement project can be done using web based system. Web based system will support all platforms such Apple and Linux. This can create awareness about the importance to apply ergonomics in human daily life. Through this software development, people will be experiencing a much healthier and productive lifestyle.

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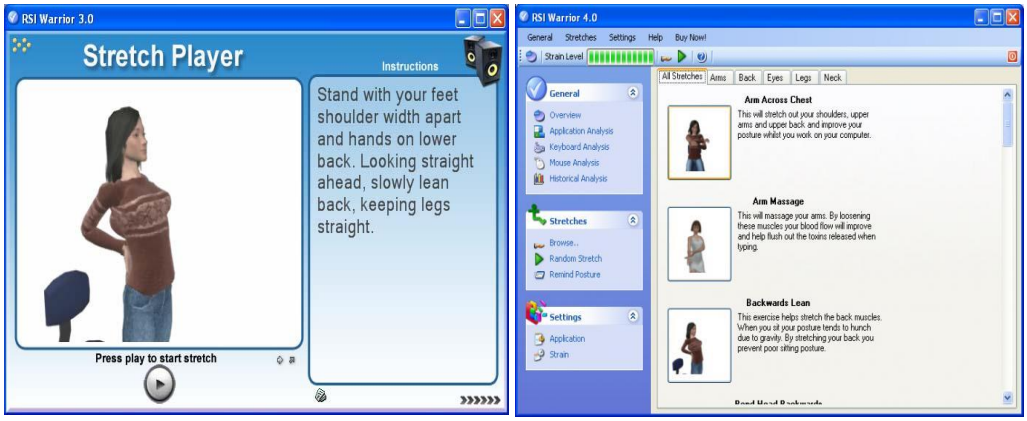
APPENDIX 1

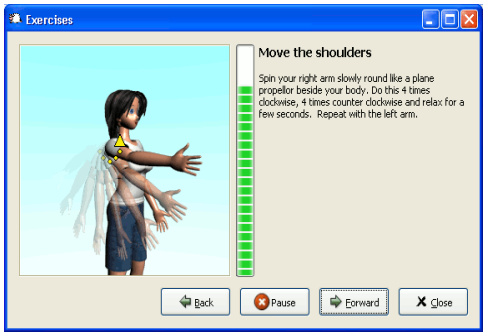
Existing Software

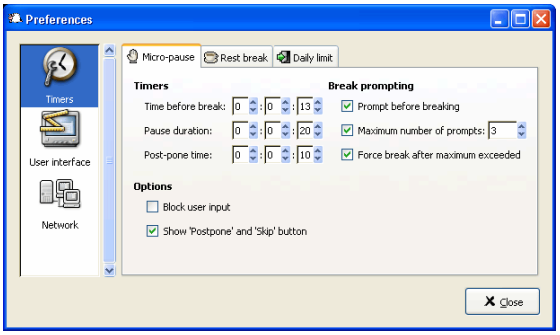
1. Off4Fit

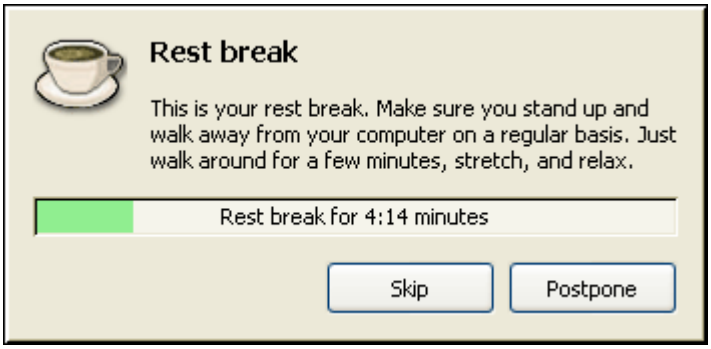
2. RSI Warrior



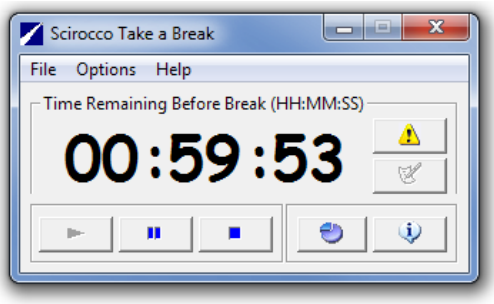
3. Workrave

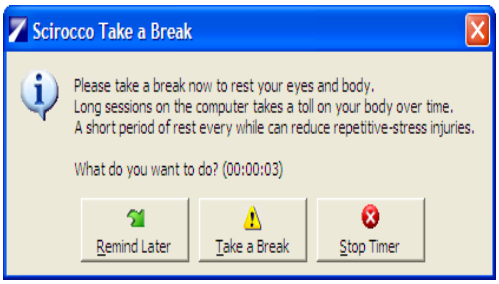


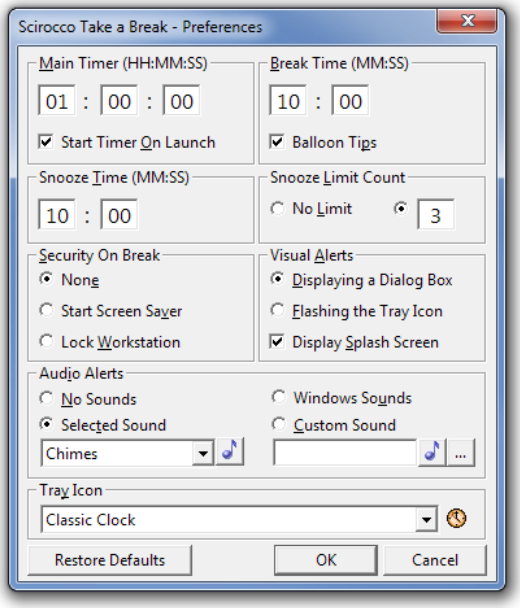




4. Scirocco Take A Break







APPENDIX 2

Name: …….. Date: ...../...../…..

Career: ……

System Usability Scale

Instructions: For each of the following statements, mark one box that best describes your reactions to the website *today*.

		Strongly Disagree				Strongly Agree
1.	I think that I would like to use this software frequently.	☐	☐	☐	☐	☐
2.	I found this software unnecessarily complex.	☐	☐	☐	☐	☐
3.	I thought this software was easy to use.	☐	☐	☐	☐	☐
4.	I think that I would need assistance to be able to use this software.	☐	☐	☐	☐	☐
5.	I found the various functions in this software were well integrated.	☐	☐	☐	☐	☐
6.	I thought there was too much inconsistency in this software.	☐	☐	☐	☐	☐
7.	I would imagine that most people would learn to use this software very quickly.	☐	☐	☐	☐	☐
8.	I found this software very cumbersome/awkward to use.	☐	☐	☐	☐	☐
9.	I felt very confident using this software.	☐	☐	☐	☐	☐
10.	I needed to learn a lot of things before I could get going with this software.	☐	☐	☐	☐	☐

Please provide any comments about this software:

This questionnaire is based on the System Usability Scale (SUS), which was developed by John Brooke while working at Digital Equipment Corporation.